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OPERATING EFFICIENCY OF COMPUTERS

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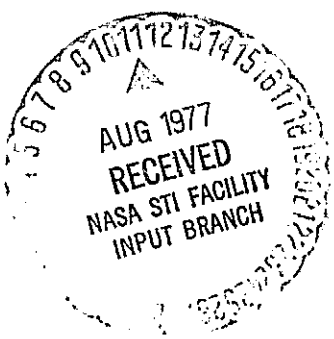

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16. Abstract

The article outlines a method which can be used to guarantee to users of computing systems a measure of operating efficiency in the following sense:

1. The monthly utilization coefficient will be equal to or exceed a value agreed on in advance.
2. The repair time during a computer breakdown will not be longer than a period agreed on in advance.

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OPERATING EFFICIENCY OF COMPUTERS

J. Pac

The number of organizations confronted with the problem of measuring, ensuring and controlling the operating efficiency of computers keeps increasing with the increase in the number of computers in all branches of the national economy. The purpose of this contribution is to summarize methods not used until now and to outline the possibilities for their subsequent development. /499

User's Requirements on Operating Efficiency of a Computer

In batch processing the user requires that the computer solve a certain number of problems, and also that during computer breakdowns the calendar time period which elapses from the time the program is read into the computer until the problem is successfully solved does not exceed an arbitrary predetermined period. If the proper segmenting of programs with the aid of checkpoints [1] is used, the number N of problems solved in a particular calendar period is given with sufficient accuracy by the relation

$$N = Pt_{t\cdot o\cdot} \cdot k_{t\cdot u}$$

where P is the performance of the computer [2, 3], $t_{t\cdot o}$ is the time at which the computer is turned on in this calendar period, and $k_{t\cdot u}$ is the technical utilization coefficient, which can be planned using the relation

$$k_{t\cdot u.} \leq \begin{cases} T_m + T_o \\ \\ T_m \end{cases}$$

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* Numbers in the margin indicate pagination in the foreign text.

The mean time between failures T_m is specified by the manufacturer (Table 1), and the mean renewal (sic)[1] time T_o should be specified in the technical computer maintenance manual [4].

TABLE 1. DISC UNIT RELIABILITY PARAMETERS
(according to foreign documentation)

The mean time between failures (MTBF) after the initial 200-hour period should exceed 1200 hours provided technical maintenance functions are properly performed. MTBF is defined as follows:

$$\text{MTBF} = \frac{\text{operating time}}{\text{number of equipment failures}}$$

The operating time is defined as the clocked time from the instant the computer was turned on minus all maintenance time. A failure is defined as any breakdown or substandard performance requiring unscheduled repair, except breakdown or substandard performance caused by the computer operator, an adverse environment, defective network, faulty control unit, defective cable or any other malfunction not caused by the equipment. To detect the actual MTBF, the operating time must exceed 2500 hours.

The mean time to repair (MTTR), which should be 2 man-hours, is defined as the time required by trained and competent workers to diagnose and repair the equipment.

Preventive maintenance time. Scheduled (preventive) maintenance must not exceed 1 man-hour per 200 operating hours.

Control of Operating Efficiency

/500

To achieve agreement between the scheduled and actual operating efficiency, large service organizations use the following control method. The initial information used for control is the technician's report about the adjustments or repairs made [5],

[1] Translator's remark: possibly restart or repair time.

which is entered either in the log or preferably on a special form. This report, which included quantitative and qualitative data on adjustments or repairs made (user's designation, beginning and end of adjustments or repairs made, address in control counter, time at which computer was turned on, reason for making adjustment or repair and method utilized, list of spare components used) is submitted by the technician to his supervisor for approval and then processed on the computer. Should the time period which elapses from the instant the technician begins to make the adjustment or repair to its successful completion turn out to be longer than the arbitrary preselected time (for example, if while repairing a computer, a technician finds out that he needs a few additional working hours to receive a spare component), he must report this fact to the appropriate supervisor (dispatcher and scheduler), who takes the necessary steps (sends a technician-specialist, ensures faster delivery of spare component, or in an extreme case replacement of the entire equipment).

A statistical treatment of the stored data on adjustments and repairs made by technicians in a particular calendar period provides the following information to the service organization:

-- mean time between failures
-- mean renewal (sic) time (or mean time to repair and down time)
-- data on spare components used up

Comparing all corresponding data for individual computers to each other, to results of tests made by the manufacturer, and to planned spare component inventory levels in warehouses, the service organization is able to:

-- make an analysis for those computers for which the values of the technical utilization coefficient are smaller than the arbitrary predetermined values, showing whether the reason was a short MTBF of certain equipment, insufficient standby equipment, a long renewal (sic) time or a shortage of spare components in inventory.

-- implement one or several of the following measures on the basis of this analysis:

a. hand over to the manufacturer some equipment for repairs

b. change configuration of computer standby equipment (for instance, install an additional printer)

c. change organization of service center or its pool of transportation means

d. change the available stock of certain spare components in warehouse.

-- take advantage of better results achieved by individual staff members and teams by implementing their methods in the entire service organization

-- propose design or technological changes to manufacturer.

Guarantee of Operating Efficiency

From the above it is evident that as long as the reliability parameters specified by the manufacturer are trustworthy, as long as the computer design meets the specific requirements of the user, and as long as the service organization controls the operating efficiency in the manner described, a guarantee can be given to the user that:

1. the technical utilization coefficient (calculated for a monthly period) will not be smaller than the arbitrary preselected value
2. the duration of a single computer repair will not be longer than the arbitrary preselected period (for example two working days).

REFERENCES

1. Lacko, B., "Computation safeguards using oriented-stop system," Mech. a autom. administrativy 10, 1972.

2. Benda, Z and I. Rukovansky, "Problems and methods in evaluating the performance of digital computers," Vyber 6, 1972.

3. Pac, J., "Design of computer taking into consideration its reliability and repair capability," Slaboprondy obzor, 7, 1974.

4. Pac, J., "Rapair capability of a computer," Automatizace, 6, 1974.

5. Molyarko, I. I., "Application of statistical methods to quality control and reliability of electronic computers in the manufacturing and operational stages," Nadezhnost' i kontrol' kachestva, 5, 1974.